vations containing total cloud amount. Since it was not required that observations contain both total and low cloud amounts, the number of observations with low cloud amount is less than that for total cloud. Thus, two different populations are used to compute the cumulative percent frequency curves for the total and low cloud amounts. This leads to inconsistencies where low cloud amount appears higher than the total cloud amount. In all cases these were resolved in favor of the total cloud by making the frequency curves coincide.

The cumulative percent frequency of any cloud amount equal to or less than the amount intersected by the curve may be read for total cloud along the solid line or low cloud along the dashed line. The frequency of obscured conditions may be determined by subtracting from 100% the cumulative percentage frequency corresponding to 8/8 coverage. The bar graph portion of the figure shows the percent frequency of low cloud amount equal to or greater than 5/8 and equal to or greater than 7/8 with each wind direction and calm (obscurations are considered as 8/8 coverage for these purposes).

CEILING AND VISIBILITY

Simultaneous ceiling-visibility contingencies are presented in isopleth and tabular form. They are designed as an aid to situations where both vertical and horizontal visibility are the major items of concern.

WIND - VISIBILITY - CLOUDINESS

This series of charts is designed to give the planner a qualitative estimate of the probability of occurrence of certain significant operational conditions. The conditions for optimum and poor carrier operations are those recommended by the users of the earlier atlas series. Of the elements used in these statistics, height of low cloud ceiling has the least reliability in the case of transient ship observations. The analyses were accomplished, however, by keying to the OWS data and adjusting the isopleths over the remainder of the area.

It should be noted that in both the contingency tables and the isopleths, the poor carrier operation conditions are *and/or* situations. This means if any one of the poor conditions of ceilings, visibility or wind speed exists, the event is counted under poor. However, in the case of optimum conditions it is an *and* situation. That is, the ceiling must be $\geq$ 5000 feet *and* visibility $\geq$ 5 nautical miles *and* wind 11-21 knots.

SEA LEVEL PRESSURE AND MEAN WIND

Two sets of wind statistics are presented. The vector mean wind is shown by arrows (direction of flow toward the station dot with the magnitude of the vector plotted at the end of the arrow). The scalar mean speed without regard to direction is shown by isopleth analysis. In areas of high persistence of direction, the magnitude of the mean vector should approximate the scalar mean speed. Pressure graphs and charts are shown.

WAVES (<1.5 AND <2.5 METERS)

In these analyses, the higher of the sea or swell is selected for summarization. If the heights are equal, the wave with the longer period is selected.

In order to present as broad a spectrum of heights and periods as practicable, two sets of wave charts are furnished.

The graphs accompanying the wave heights <1.5 and <2.5 meter analyses are wave height versus wave direction. The bar graph and the percent scale at the top of the chart give the percent frequency of waves from each direction. Indeterminate directions are combined with calms. The percent frequency of wave heights (bottom scale) may be read for each height interval and wave direction from the contingency table. The isopleth analyses of the percent frequency of heights <1.5 and <2.5 meters are for generally non-hazardous sea conditions.

WAVES ($\geq$3.5 AND $\geq$6 METERS)

Wave heights in the ≥ 3.5 and ≥ 6 meter range represent increasingly hazardous conditions. Accompanying these charts are contingency tables of wave heights versus period.

LOW PRESSURE CENTERS

The roses, tracks and cyclogenetical areas are based on 9 years of track charts (May 1965-April 1974) prepared by the National Meteorological Center. These charts show cyclone tracks based on 6-hourly positions of closed centers. During the past decade, the added dimension of satellite surveillance has helped to improve the reliability of analyses over the oceans. The addition of the later data has confirmed the general positions of the tracks shown by Klein (1957) but some minor adjustments appear to be warranted.

Frequencies of cyclone centers passing through 2½ degree "squares" were analyzed to obtain the mean tracks. Primary tracks were selected along the axes of maximum frequency and secondary tracks were selected along axes where there was a moderate frequency.

The number of individual centers entering the area was subtracted from the number observed in an area to obtain the frequency of origins. These numbers were then analyzed to find regions of cyclogenesis (only formation, not intensification). In order to show that the depicted areas are general as opposed to specific, no borders are drawn around them.

The legend shows how to read the roses. In the model, the figure printed at the end of each bar represents the mean speed of movement (in knots) of all storms which moved toward this direction. The length of the bar represents the percent frequency of centers which moved toward that direction. The scale is given by arcs of circles labeled in percentage. The arcs of circles are also labeled in speed and refer to the mean vector movement as represented by the dot. The top figure within the inner circle represents the number of 12-hour storm movements in the quadrangle during the period of record. The bottom figure indicates the number of individual storms used in the computations.

TROPICAL CYCLONES

The tropical cyclone (wind speeds $\geq$34 knots) roses in this atlas are reprinted from the Mariners Worldwide Climatic Guide to Tropical Storms at Sea, NAVAIR 50-1C-61, 1974.

The data presented here are the tropical storm (wind speeds 34-63 knots) and hurricane stages (wind speeds $\geq$64 knots) combined for the 5° quadrangles. The period of record is 1871-1971. The reader is referred to the above mentioned "Guide" for roses of the individual stages.

The rose-type presentation is basically similar to that for low pressure centers except one additional statistic is provided: the lower most number within the rose center indicates the percent of years of record in which storms occurred within the 5° quadrangle.

DAYLIGHT - DARKNESS

This Daylight-Darkness Chart for the Northern Hemisphere defines daylight as the period from sunrise to sunset. As an example, the daylight on July 20 of any year at 48° N is about 15 hours and 30 minutes for any